

WHAT IS CLAIMED IS:

1 1. A method of simulating an operation of a logical unit,  
2 comprising:

3 a resource requesting step in which a thread manager,  
4 which controls threads each forming an execution unit of a  
5 program, makes a request for a hardware resource needed for  
6 execution of each of threads representative of a series of  
7 functions required until the operation of said logical unit  
8 reaches completion according to a design specification of  
9 said logical unit, to a resource manager which manages said  
10 hardware resource;

11 a resource allocating step in which said resource manager  
12 allocates said hardware resource meeting said request to said  
13 thread in accordance with a rule prescribed in advance; and

14 a thread control step in which said thread manager  
15 controls an execution state of said thread in accordance with  
16 a result of the allocation made by said resource manager,  
17 said thread manager and said resource manager executing  
18 said steps repeatedly in cooperation with each other until  
19 the execution of said thread reaches completion, for  
20 simulating the operation of said logical unit to be conducted  
21 up to the completion.

1 2. A method of simulating an operation of a logical unit  
2 according to claim 1, wherein said series of functions are  
3 represented in a plurality of sequential threads.

1 3. A method of simulating an operation of a logical unit  
2 according to claim 1, wherein said series of functions are  
3 represented in a plurality of sequential or concurrently  
4 executed threads.

1 4. A method of simulating an operation of a logical unit  
2 according to claim 1, wherein a plurality of resource managers  
3 each corresponding to said resource manager are provided in  
4 conjunction with the types of said hardware resources, and  
5 in said resource allocating step, each of said resource  
6 managers allocates said hardware resource, said resource  
7 manager manages, to said thread in accordance with a local  
8 rule described in advance.

1 5. A method of simulating an operation of a logical unit  
2 according to claim 1, wherein a plurality of resource managers  
3 each corresponding to said resource manager are provided in  
4 conjunction with the types of said hardware resources and  
5 are hierarchized according to the dependence among said  
6 hardware resources, and  
7 in said resource allocating step, the hardware resource  
8 allocation is made in consideration of the dependence between  
9 said hardware resource managed by one of said resource managers  
10 manages and said hardware resource managed by the other  
11 resource manager lower in hierarchy than the one of said  
12 resource managers.

1 6. A method of simulating an operation of a logical unit  
2 according to claim 1, wherein said resource manager monitors  
3 resource requests in said resource requesting step to make  
4 a decision on a resource request deadlock state among a  
5 plurality of threads on a result of the monitoring.

1 7. A method of simulating an operation of a logical unit  
2 according to claim 1, wherein said resource manager monitors  
3 read/write requests with respect to said hardware resource  
4 allocated by said resource request in said resource requesting  
5 step to make a decision on a competition state in read/write  
6 operation on said hardware resource among a plurality of  
7 threads on the basis of a result of the monitoring.

1 8. A method of simulating an operation of a logical unit  
2 according to claim 1, wherein said resource manager monitors  
3 the number of resource requests with respect to said hardware  
4 resource to detect a bottleneck on said thread on the basis  
5 of a result of the monitoring.

1 9. A method of simulating an operation of a logical unit  
2 according to claim 1, wherein said resource manager monitors  
3 the number of resource requests with respect to said hardware  
4 resource to detect blocking of said resource requests on the  
5 basis of a result of the monitoring.

1 10. A method of simulating an operation of a logical unit

2 according to claim 1, wherein said thread has a budget on  
3 a time of occupancy of a hardware resource allocated by said  
4 resource manager.

1 11. A method of simulating an operation of a logical unit  
2 according to claim 1, wherein said thread has an execution  
3 time-limit on said function.

1 12. A method of simulating an operation of a logical unit,  
2 comprising:

3 a resource requesting step in which a thread manager,  
4 which controls threads each forming an execution unit of a  
5 program, makes a request for a hardware resource needed for  
6 execution of each of a series of threads representative of  
7 functions required until the operation of said logical unit  
8 reaches completion according to a design specification of  
9 said logical unit, to a resource manager which manages said  
10 hardware resource;

11 a resource allocating step in which said resource manager  
12 allocates said hardware resource meeting said request to said  
13 thread in accordance with a rule prescribed in advance;

14 a thread control step in which said thread manager  
15 controls an execution state of said thread in accordance with  
16 a result of the allocation made by said resource manager,  
17 with said thread manager and said resource manager  
18 executing said steps repeatedly in cooperation with each other  
19 until the execution of said thread reaches completion, for

20     simulating the operation of said logical unit to be conducted  
21     up to the completion,  
22         said method further comprising:  
23         a comparison step of comparing a result of the simulation  
24     with an estimated value on said operation of said logical  
25     unit; and  
26         an output step of outputting a result of the comparison  
27     in said comparison step to an external unit.

1     13. An apparatus for simulating an operation of a logical  
2     unit, comprising:  
3         a thread manager for controlling a thread forming an  
4     execution unit of a program; and  
5         a resource manager for managing a hardware resource  
6     needed for execution of said thread,  
7         said thread manager including:  
8         resource requesting means for making a request for  
9     a hardware resource needed for execution of a thread  
10    representative of functions required until the operation of  
11    said logical unit reaches completion according to a design  
12    specification of said logical unit, to said resource manager;  
13    and  
14         thread control means for controlling an execution  
15    state of said thread in accordance with a result of a resource  
16    allocation made by said resource manager in response to the  
17    request from said resource requesting means,  
18         said resource manager including:

19 resource allocating means for allocating a hardware  
20 resource meeting the request to said thread in accordance  
21 with a rule prescribed in advance,  
22 said thread manager and said resource manager conducting  
23 the resource request and the control of the thread execution  
24 state repeatedly in cooperation with each other until the  
25 execution of said thread reaches completion, for simulating  
26 the operation of said logical unit to be conducted up to the  
27 completion.

1 14. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit,

3 said simulation program making a computer function as  
4 a thread manager for controlling threads each forming an  
5 execution unit of said program and as a resource manager for  
6 managing a hardware resource needed for execution of each  
7 of threads, and

8 said simulation program executing:

9 a resource requesting step in which said thread  
10 manager makes a request for a hardware resource needed for  
11 execution of threads representative of a series of functions  
12 required until the operation of said logical unit reaches  
13 completion according to a design specification of said logical  
14 unit, to said resource manager;

15 a resource allocating step in which said resource  
16 manager allocates said hardware resource meeting the request  
17 to said thread in accordance with a rule prescribed in advance;

18 and

19 a thread control step in which said thread manager  
20 controls an execution state of said thread in accordance with  
21 a result of the allocation made by said resource manager,  
22 said thread manager and said resource manager executing  
23 said steps repeatedly in cooperation with each other until  
24 the execution of said thread reaches completion, for  
25 simulating the operation of said logical unit to be conducted  
26 up to the completion.

1 15. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 14, wherein a plurality of resource managers each  
4 corresponding to said resource manager are provided in  
5 conjunction with the types of hardware resources, and  
6 in said resource allocating step, each of said resource  
7 managers allocates said hardware resource, said resource  
8 manager manages, to said thread in accordance with a local  
9 rule described in advance.

1 16. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 14, wherein a plurality of resource managers each  
4 corresponding to said resource manager are provided in  
5 conjunction with the types of hardware resources and are  
6 hierarchized according to the dependence among said hardware  
7 resources, and

8           in said resource allocating step, the hardware resource  
9   allocation is made in consideration of the dependence between  
10   said hardware resource managed by one of said resource managers  
11   and said hardware resource managed by the other resource  
12   manager lower in hierarchy than the one of said resource  
13   managers.

1   17. A computer readable recording medium retaining a program  
2   for simulation of an operation of a logical unit according  
3   to claim 14, wherein said resource manager monitors resource  
4   requests in said resource requesting step to make a decision  
5   on a resource request deadlock state among a plurality of  
6   threads on a result of the monitoring.

1   18. A computer readable recording medium retaining a program  
2   for simulation of an operation of a logical unit according  
3   to claim 14, wherein said resource manager monitors read/write  
4   requests with respect to said hardware resource allocated  
5   by said resource request in said resource requesting step  
6   to make a decision on a competition state in read/write  
7   operation on said hardware resource among a plurality of  
8   threads on the basis of a result of the monitoring.

1   19. A computer readable recording medium retaining a program  
2   for simulation of an operation of a logical unit according  
3   to claim 14, wherein said resource manager monitors the number  
4   of resource requests with respect to said hardware resource



5 to detect a bottleneck on said thread on the basis of a result  
6 of the monitoring.

1 20. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 14, wherein said resource manager monitors the number  
4 of resource requests with respect to said hardware resource  
5 to detect blocking of said resource requests on the basis  
6 of a result of the monitoring.

1 21. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 14, wherein said thread has a budget on a time of  
4 occupancy of a hardware resource allocated by said resource  
5 manager.

1 22. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 14, wherein said thread has an execution time-limit  
4 on said function.

1 23. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 14, wherein said series of functions are represented  
4 in a plurality of sequential threads.

1 24. A computer readable recording medium retaining a program

2 for simulation of an operation of a logical unit according  
3 to claim 23, wherein a plurality of resource managers each  
4 corresponding to said resource manager are provided in  
5 conjunction with the types of hardware resources, and  
6 in said resource allocating step, each of said resource  
7 managers allocates said hardware resource, said resource  
8 manager manages, to said thread in accordance with a local  
9 rule described in advance.

1 25. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 23, wherein a plurality of resource managers each  
4 corresponding to said resource manager are provided in  
5 conjunction with the types of hardware resources and are  
6 hierarchized according to the dependence among said hardware  
7 resources, and  
8 in said resource allocating step, the hardware resource  
9 allocation is made in consideration of the dependence between  
10 said hardware resource managed by one of said resource managers  
11 and said hardware resource managed by the other resource  
12 manager lower in hierarchy than the one of said resource  
13 managers.

1 26. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 23, wherein said resource manager monitors resource  
4 requests in said resource requesting step to make a decision

5 on a resource request deadlock state among a plurality of  
6 threads on a result of the monitoring.

1 27. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 23, wherein said resource manager monitors read/write  
4 requests with respect to said hardware resource allocated  
5 by said resource request in said resource requesting step  
6 to make a decision on a competition state in read/write  
7 operation on said hardware resource among a plurality of  
8 threads on the basis of a result of the monitoring.

1 28. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 23, wherein said resource manager monitors the number  
4 of resource requests with respect to said hardware resource  
5 to detect a bottleneck on said thread on the basis of a result  
6 of the monitoring.

1 29. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 23, wherein said resource manager monitors the number  
4 of resource requests with respect to said hardware resource  
5 to detect blocking of said resource requests on the basis  
6 of a result of the monitoring.

1 30. A computer readable recording medium retaining a program

2 for simulation of an operation of a logical unit according  
3 to claim 23, wherein said thread has a budget on a time of  
4 occupancy of a hardware resource allocated by said resource  
5 manager.

1 31. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 23, wherein said thread has an execution time-limit  
4 on said function.

1 32. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 14, wherein said series of functions are represented  
4 in a plurality of sequential or concurrently executed threads.

1 33. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 32, wherein a plurality of resource managers each  
4 corresponding to said resource manager are provided in  
5 conjunction with the types of hardware resources, and  
6 in said resource allocating step, each of said resource  
7 managers allocates said hardware resource, said resource  
8 manager manages, to said thread in accordance with a local  
9 rule described in advance.

1 34. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according

3 to claim 32, wherein a plurality of resource managers each  
4 corresponding to said resource manager are provided in  
5 conjunction with the types of hardware resources and are  
6 hierarchized according to the dependence among said hardware  
7 resources, and

8 in said resource allocating step, the hardware resource  
9 allocation is made in consideration of the dependence between  
10 said hardware resource managed by one of said resource managers  
11 and said hardware resource managed by the other resource  
12 manager lower in hierarchy than the one of said resource  
13 managers.

1 35. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 32, wherein said resource manager monitors resource  
4 requests in said resource requesting step to make a decision  
5 on a resource request deadlock state among a plurality of  
6 threads on a result of the monitoring.

1 36. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 32, wherein said resource manager monitors read/write  
4 requests with respect to said hardware resource allocated  
5 by said resource request in said resource requesting step  
6 to make a decision on a competition state in read/write  
7 operation on said hardware resource among a plurality of  
8 threads on the basis of a result of the monitoring.

1 37. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 32, wherein said resource manager monitors the number  
4 of resource requests with respect to said hardware resource  
5 to detect a bottleneck on said thread on the basis of a result  
6 of the monitoring.

1 38. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 32, wherein said resource manager monitors the number  
4 of resource requests with respect to said hardware resource  
5 to detect blocking of said resource requests on the basis  
6 of a result of the monitoring.

1 39. A computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 32, wherein said thread has a budget on a time of  
4 occupancy of a hardware resource allocated by said resource  
5 manager.

1 40. computer readable recording medium retaining a program  
2 for simulation of an operation of a logical unit according  
3 to claim 32, wherein said thread has an execution time-limit  
4 on said function.

1 41. A computer readable recording medium retaining a program

2 for simulation of an operation of a logical unit,  
3 said simulation program making a computer execute:  
4 a resource requesting step in which a thread manager,  
5 which controls threads each forming an execution unit of a  
6 program, makes a request for a hardware resource needed for  
7 execution of each of threads representative of functions  
8 required until the operation of said logical unit reaches  
9 completion according to a design specification of said logical  
10 unit, to a resource manager which manages said hardware  
11 resource;  
12 a resource allocating step in which said resource manager  
13 allocates said hardware resource meeting said request to said  
14 thread in accordance with a rule prescribed in advance;  
15 a thread control step in which said thread manager  
16 controls an execution state of said thread in accordance with  
17 a result of the allocation made by said resource manager,  
18 said thread manager and said resource manager executing  
19 said steps repeatedly in cooperation with each other until  
20 the execution of said thread reaches completion, for  
21 simulating the operation of said logical unit to be conducted  
22 up to the completion, and  
23 said method further comprising:  
24 a comparison step of comparing a result of the simulation  
25 with an estimated value on said operation of said logical  
26 unit; and  
27 an output step of outputting a result of the comparison  
28 in said comparison step to an external unit.